11011 U.S. PTO
09/920728
08/03/01

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

| | | |
|---|---|---|
| In re Application of: | : | |
| Robert James TRIBE et al. | : | |
| Serial No. | : | Art Unit: |
| Filed: concurrently herewith | : | Examiner: |
| For: SYRINGE PUMPS | : | Atty Docket: 0100/0131 |

#5

**SUBMISSION OF PRIORITY DOCUMENT**

Assistant Commissioner for Patents
Washington, D.C. 20231

Sir:

Attached hereto please find a certified copy of applicant's patent application No. 0020060.0 filed in Great Britain on August 16, 2000. Applicant requests the benefit of said August 16, 2000 filing date for priority purposes pursuant to the provisions of 35 USC 119.

Respectfully submitted,

Louis Woo, Reg. No. 31,730
Law Offices of Louis Woo
1901 N. Fort Myer Drive, Suite 501
Arlington, Virginia 22209
Phone: (703) 522-8872

Date: Aug 3 2001

The Patent Office
Concept House
Cardiff Road
Newport
South Wales
NP10 8QQ

INVESTOR IN PEOPLE

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09/920728
08/03/01

I, the undersigned, being an officer duly authorised in accordance with Section 74(1) and (4) of the Deregulation & Contracting Out Act 1994, to sign and issue certificates on behalf of the Comptroller-General, hereby certify that annexed hereto is a true copy of the documents as originally filed in connection with the patent application identified therein.

In accordance with the Patents (Companies Re-registration) Rules 1982, if a company named in this certificate and any accompanying documents has re-registered under the Companies Act 1980 with the same name as that with which it was registered immediately before re-registration save for the substitution as, or inclusion as, the last part of the name of the words "public limited company" or their equivalents in Welsh, references to the name of the company in this certificate and any accompanying documents shall be treated as references to the name with which it is so re-registered.

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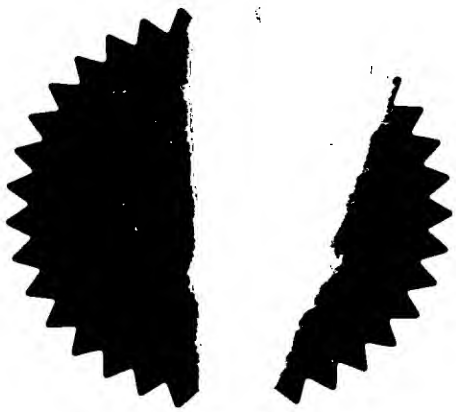

Signed Andrew Gerrey

Dated 17 JUL 2001

Patents Form 1/77

Patents Act 1977
(Rule 1)

THE PATENT OFFICE
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16 AUG 2000
NEWPORT

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# Request for grant of a patent

*(See the notes on the back of this form. You can also get an explanatory leaflet from the Patent Office to help you fill in this form)*

The Patent Office

Cardiff Road
Newport
South Wales
NP10 8QQ

1. Your reference

00.ABBO

2. Patent application number
*(The Patent Office will fill in this part)*

**0020060.0**

3. Full name, address and postcode of the or of each applicant *(underline all surnames)*

SMITHS INDUSTRIES PUBLIC LIMITED COMPANY
765 FINCHLEY ROAD
LONDON
NW11 8DS

Patents ADP number *(if you know it)*

~~728708002~~ 7570500 2

If the applicant is a corporate body, give the country/state of its incorporation

GB

4. Title of the invention

16AUG00 E560969-1 007234
P01/7700 0.00-0020060.0

SYRINGE PUMPS

5. Name of your agent *(if you have one)*

J. M. FLINT

"Address for service" in the United Kingdom to which all correspondence should be sent *(including the postcode)*

765 FINCHLEY ROAD
LONDON
NW11 8DS

Patents ADP number *(if you know it)*

1063288002

6. If you are declaring priority from one or more earlier patent applications, give the country and the date of filing of the or of each of these earlier applications and *(if you know it)* the or each application number

| Country | Priority application number *(if you know it)* | Date of filing *(day / month / year)* |
|---|---|---|

7. If this application is divided or otherwise derived from an earlier UK application, give the number and the filing date of the earlier application

| Number of earlier application | Date of filing *(day / month / year)* |
|---|---|

8. Is a statement of inventorship and of right to grant of a patent required in support of this request? *(Answer 'Yes' if:*

*a) any applicant named in part 3 is not an inventor, or*
*b) there is an inventor who is not named as an applicant, or*
*c) any named applicant is a corporate body.*
*See note (d))*

YES

9. Enter the number of sheets for any of the following items you are filing with this form. Do not count copies of the same document

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| Continuation sheets of this form | |
| Description | 4 |
| Claim(s) | |
| Abstract | 1 |
| Drawing(s) | 1 |

10. If you are also filing any of the following, state how many against each item.

| | |
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| Priority documents | |
| Translations of priority documents | |
| Statement of inventorship and right to grant of a patent *(Patents Form 7/77)* | |
| Request for preliminary examination and search *(Patents Form 9/77)* | |
| Request for substantive examination *(Patents Form 10/77)* | |
| Any other documents *(please specify)* | |

11. I/We request the grant of a patent on the basis of this application.

Signature J Flint Date 15 Aug 2000

12. Name and daytime telephone number of person to contact in the United Kingdom J. M. FLINT 020 8457 8220

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**Notes**

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b) *Write your answers in capital letters using black ink or you may type them.*

c) *If there is not enough space for all the relevant details on any part of this form, please continue on a separate sheet of paper and write "see continuation sheet" in the relevant part(s). Any continuation sheet should be attached to this form.*

d) *If you have answered 'Yes' Patents Form 7/77 will need to be filed.*

e) *Once you have filled in the form you must remember to sign and date it.*

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# SYRINGE PUMPS

This invention relates to syringe pumps.

Syringe pumps are used to supply medication to a patient from a pre-filled syringe via an infusion line. The syringe pump applies a force to the plunger of the syringe to drive medication into the infusion line at a controlled rate. It is common to have some provision to detect occlusion to flow of liquid out of the pump, such as caused by kinked tubing, and to respond to this by stopping the pump and sounding an alarm. The occlusion may be detected by measuring the force exerted on the plunger head by the pump driver, to detect excessive force. As described in GB0014483, the plunger head retainer itself may include a force sensor. The excess force produced until the occlusion is detected is accomodated by deformation of the elastic components, such as the fluid tubing and the syringe plunger head. When the pump is stopped, therefore, the medication fluid upstream of the occlusion is subject to compressive forces. When the occlusion is cleared, such as by straightening kinked tubing, the compressive force may cause a bolus of medication to flow to the patient. This can, in some situations, present a hazard to the patient.

It is an object of the present invention to provide an alternative syringe pump and method of operation.

According to one aspect of the present invention there is provided a syringe pump adapted to receive a syringe of the kind having a plunger movable along a barrel, the pump including means for detecting an occlusion to flow of medication from the syringe, and the

pump being operable in response to a detected occlusion to reverse the drive applied to move the plunger along the barrel sufficiently to reduce excess force on the medication caused by the occlusion.

The means for detecting occlusion preferably includes a force sensor and the pump may be arranged to reverse the drive until force detected by the sensor reaches a predetermined level. The pump may be arranged to reverse the drive until the force detected by the force sensor is substantially 10% of the force at which an occlusion is detected.

According to a second aspect of the present invention there is provided a method of controlling a syringe pump including the steps of applying a force to drive a plunger along a barrel of a syringe to dispense medication, detecting an occlusion to the flow of medication out of the syringe, responding to a detected occlusion by reversing the drive on the plunger sufficient to reduce excess pressure on the medication.

According to a third aspect of the present invention there is provided a method of controlling a syringe pump including the steps of applying a force to drive a plunger along a barrel of a syringe to dispense medication, detecting force on the plunger, responding to a force on the plunger above a predetermined value by changing the force applied to drive the plunger so that the detected force reduces below the predetermined value.

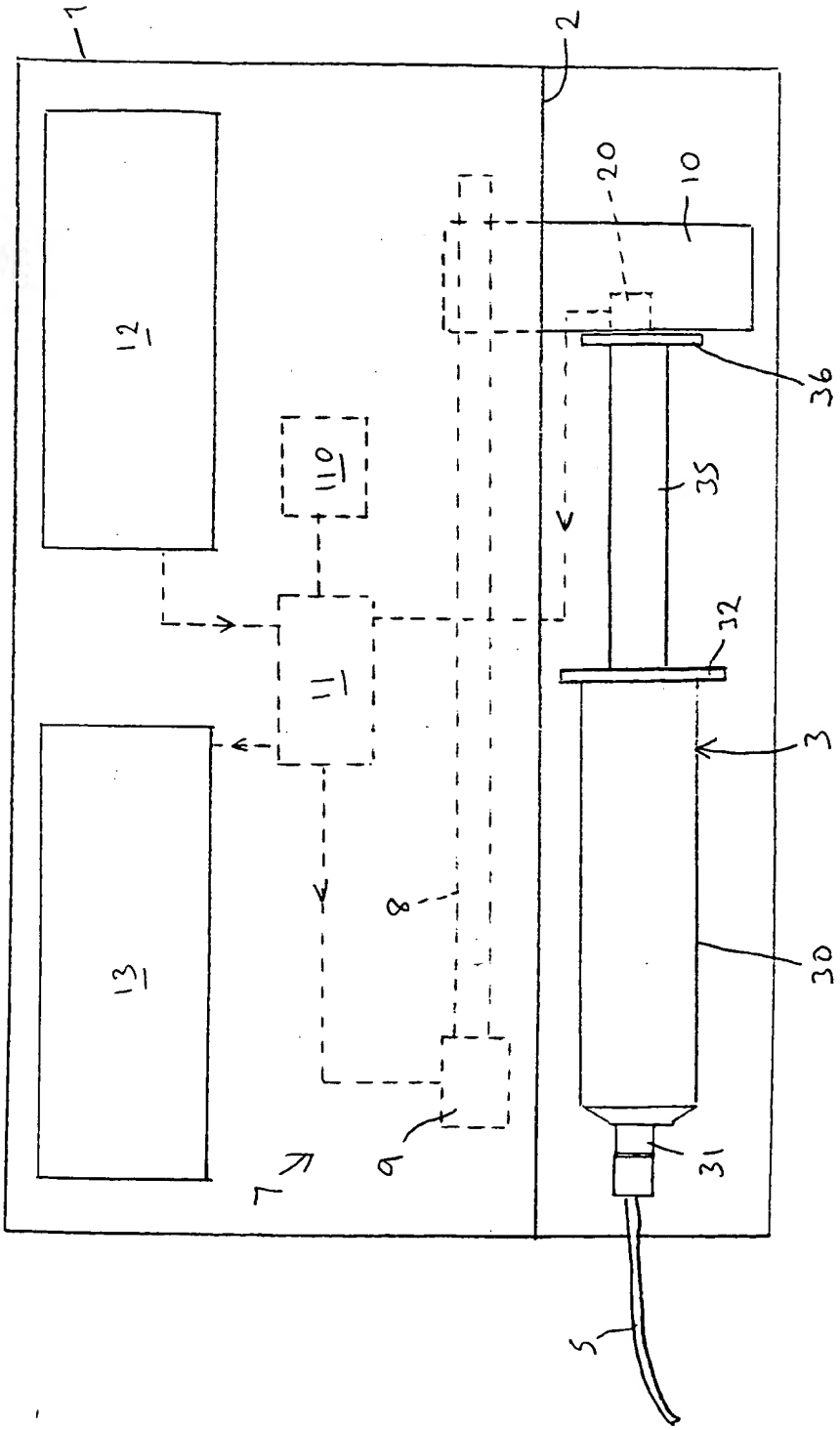
A syringe pump and its method of operation, according to the present invention, will now be described, by way of example, with reference to the accompanying drawing, which is a simplified view of the front of the pump.

The pump includes an outer housing 1 with a recess 2 on its front surface shaped to receive a syringe 3 of conventional kind. The syringe 3 has a cylindrical barrel 30 with an outlet or nose 31 at its forward end and a flange or ear 32 at its rear end. The nose 31 is connected to an infusion line 5 so that a medication liquid in the syringe 3 can be dispensed to a patient via the infusion line, by pushing in the plunger 35. The pump has a drive mechanism 7, including a lead screw 8 driven by an electric motor 9. A retainer mechanism 10 is movable along the lead screw as it rotates and engages the head 36 of the plunger 35, so as to move the plunger along the barrel 30. The motor 9 is driven by a control unit 11, which receives inputs from a keypad 12, or other user input means, and various sensors. The control unit 11 also provides an output to a display 13.

The plunger head retainer 10 includes a force sensor 20, as described in greater detail in GB0014483, which responds to the force exerted on the plunger head 36 by the retainer and provides an output to the control unit 11. The control unit 11 includes a memory 110 containing information as to an upper, maximum predetermined value of force $F_{max}$. If this force is exceeded, it indicates an obstruction to movement of the plunger, which is usually caused by an occlusion in the path of medication from the syringe. Most commonly, such an occlusion would be caused by a kink in the infusion line 5 but it could be caused, for example, by inadvertent use of a clamp on the tubing or by a blood clot where the medication enters the patient.

The control unit 11 compares the output from the sensor 20 with the contents of the memory 110 and, if the force exceeds $F_{max}$, it provides an alarm signal, such as an audible

alarm and a warning indication on the display panel 13. The control unit 11 also stops forward drive by the motor 9 and applies signals to drive the motor in reverse until the force detected by the sensor 20 reduces to some level above zero, typically about 10% of $F_{max}$. At the same time, when this reduced level of force is detected, the control unit 11 stops drive to the motor 9 until the user clears the occlusion and restarts the pump. The force applied to the medication is considerably reduced compared with what it would be if the motor had been simply stopped on detection of the occlusion. Thus, when the occlusion is removed, such as by straightening kinked tubing, there will be no significant bolus of medication dispensed to the patient. The force on the plunger is preferably maintained slightly above zero in order to ensure that there is no reverse flow of medication along the infusion line when the occlusion is removed.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